It will be seen that the calculated results are not very dissimilar from those obtained experimentally and give reasonable support to the interpretation put forward.

These curves would serve also to show, more exactly than is shown in the text, the relative insignificance of the fourth-sensation-contribution to luminosity curves of ordinary brightness. They form also a more concrete presentment of the argument in favour of the existence of this fourth sensation.

Periodic Disturbance of Level arising from the Load of Neighbouring Oceanic Tides.

By K. TERAZAWA.

(Communicated by Sir Joseph Larmor, F.R.S. Received April 17, 1916.)

(Abstract.)

In Hecker's observations on the lunar deflection of gravity, the force apparently acting on the pendulum at Potsdam is a larger fraction of the moon's direct attraction when it acts towards east or west than when it acts towards north or south. A similar result has been found by Michelson in his observations of the lunar perturbation of water-level at Chicago. A calculation is here made to ascertain to what extent the tilting of the ground caused by the excess pressure of the tide in the North Atlantic is important for the explanation of this geodynamical discrepancy. Replacing the North Atlantic by a circular basin of radius 2000 kilom., taking the position of Chicago to be 1000 kilom. from the coast, and the rigidity of the earth to be 6×10^{11} C.G.S., it is found that the attraction effect of a uniform tide per metre of height is about $0{\cdot}0024''$, while its tilting effect is as much as $0{\cdot}0069''$, the maximum of the direct lunar attraction being $0{\cdot}017''$. If the surface of tide is ellipsoidal, shelving towards the coast, nearly the same result is reached for the same mean tidal height.

Note by Communicator.

[*July* 16.—The following proposition, which is implied in the paper, deserves explicit statement: it is readily proved for a load localised at a point,* and follows generally by superposition. A load is distributed anyhow on the earth's surface, over a region not too large to be considered as plane; for each locality it alters the level of the surface by its weight, and the direction of the vertical by its horizontal attraction; for material that is homogeneous elastically, the ratio of these two effects is in all cases the same, being $[(1-\sigma)/\mu](g/\gamma)(g/2\pi)$, where μ is the rigidity of the material and σ its ratio of lateral contraction to elongation, g is gravity, and g/γ is the mass of the earth divided by the square of its radius.* Thus, for steel, taking $\sigma = 0{\cdot}27$, $\mu = 8 \times 10^{11}$, the deflection of the surface is always and everywhere 2·1 times the deflection of the vertical, the total effect being their sum. For glass the ratio is 6·7.

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* *Cf.* Love's 'Theory of Elasticity,' para. 135.

The complete results for various distributions of load can be written down at once from known expressions for cases of attraction: for example, the case of elliptic loading (over any elliptic area), which is considered at the end of the paper.—J. L.]

Historical Note on a Relation between the Gravitational Attraction Exercised and the Elastic Depression Caused by Load on the Plane Surface of an Isotropic Elastic Solid.

By C. Chree, F.R.S.

(Received August 15, 1917.)

So far as is known, the result to which the present note refers was first given in the special form which it assumes for an incompressible material in a note written by Sir G. H. Darwin entitled, "On Variations in the Vertical due to Elasticity of the Earth's Surface," included in the British Association Report for 1882 as an Appendix to the Report of a Committee appointed for the "Measurement of the Lunar Disturbance of Gravity." Sir G. H. Darwin and Lord Kelvin (then Sir William Thomson) were members of this Committee.

On p. 108 (*loc. cit.*) Darwin writes, "Before proceeding further I shall prove a very remarkable relation between the slope of the surface of an elastic horizontal plane and the deflection of the plumb line caused by the direct attraction of the weight producing that slope. This relation was pointed out to me by Sir William Thomson, when I told him of the investigation on which

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* Since writing the above I have found that this general relation was stated by Dr. C. Chree in 1897 ('Phil. Mag.,' vol. 43, p. 177), with some particular applications to cases of rectangular loaded areas; like results had previously been given by Sir G. Darwin for the special case of a system of parallel ridges.